How to self assemble: oligomeric structures of septin complexes and sub-complexes from Ciona Intestinalis

SpT-01-4

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Over recent years much has been learnt about septin filament assembly and the specific interfaces that must spontaneously form in order to correctly build oligomers, filaments and higher-order assemblies. The latter seem to be essential for the vast majority of septin functions in membrane remodeling, bacterial entrapment and barrier formation. Most of this information has derived from mammalian systems although much of our current understanding appears to be transferable to other species, including schistosomes, fruit flies and fungi. In the current work we investigate the structures of septin complexes and sub-complexes from the sea squirt Ciona intestinalis, an interesting model system possessing only one member of each of the four animal septin subgroups (SEPT2, SEPT6, SEPT7 and SEPT9), thereby eliminating the redundancy seen in many species. We obtained single particle cryo-EM structures for the octameric, hexameric and central tetrameric particles at 9, 3.3 and 2.7Å, respectively. This has enabled us to better understand the features of the inter-subunit interfaces, essential for spontaneous assembly. In the upper part of the G-interface we rationalize the need for an Asx residue within switch II based on its unusual φ/ψ angles and in the lower part, the cluster of intercalated aromatic residues which has been largely unappreciated until now. At the NC-interface we fully describe the Hook-Loop region for this first time. This appears to be essential for each subunit to embrace its neighbor, thereby, together with a polybasic helix (α0), lending stability to the NC-interface and determining inter-subunit separation. Taken together, this study gives novel insights into the assembly of the septin oligomers, which is an elegant example of subtle molecular recognition.

This work was supported by FAPESP through grants 2020/02897-1, 2021/08158-9, 2018/20209-5, 2023/06866-1